Eighth Monthly Report of the MI BPM Upgrade
February, 2006
wbs item 1.1.3.2 of the Run 2 Luminosity Upgrade Project
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**Project Definition:**

The MI BPM Upgrade will replace the current BPM electronics and the data acquisition system used to transfer information between the BPMs and the Accelerator Controls Systems. As part of the project, the software used to read out, transfer, store, and analyze the BPM data will be upgraded. The goal of the project is to provide a BPM system based on modern hardware and software that gives the higher resolution and expanded functionality necessary to efficiently understand and operate the Main Injector now and for the foreseeable future including the needs for Run 2 and NUMI. Deliverables of the project include all relevant documentation, manuals, user's guides and any other written records necessary for maintaining the system.

**Project Manager's Summary:**

In February the project focused on making use of the beam time prior to the shutdown to learn as much as possible from the MI BPM upgrade prototype installed in House 44 (MI40). Using this prototype system the project was able to measure position and intensity (actually the sum signal) of proton and antiproton beams, in closed orbit and turn-by-turn modes, at 53 MHz and 2.5 MHz. These were all very positive steps in the understanding of the operation of the system, including sorting out triggering, timing, and data acquisition issues.

Many people and groups contributed to the MI40/House 44 prototype. The transition board gain was adjusted to study signal-to-noise and resolution. Timing for proton and antiproton turn-by-turn measurements were studied and adjusted. The timing work was also extended to the entire system to help prepare for full system commissioning after the shutdown. The Main Injector Department helped to understand the system by doing aperture scans and other tests. Some discrepancies were seen, including a sign error in applying offsets. Most were resolved but at least a few remained that will require further investigation. Many studies were performed using the data taken with the prototype system and this will continue into the future. The front end software was debugged as part of the study process. Proper corrections and offsets were implemented. Fast time plots, application programs and diagnostics were modified or developed to make use of the new system. Many of the changes were made in the BPM libraries that pass data to the applications.

In addition to the MI40 prototype system work occurred in many areas. More combiner boxes were installed in the MI tunnel when opportunities allowed. This will be completed during the shutdown. The Transition Module layout was completed and bids went out for fabrication. The bids were due at the end of February with award and board

fabrication to start in March. The Transition Module I/O system was reviewed based on experience gained with the prototype. A decision was made to design an improved card and this work has begun. All the hardware must be complete, debugged, tested and ready for installation by June 1. The Timing Board has worked well and is thought to be ready for the final installation. Some additional debugging and timing studies may well be required. All of the Dawn VME subracks have been delivered. The backplanes for the Transition Module backplanes will be ordered and acquired soon. Cables are being delivered and tested.

The project will be working on a plan to receive and test the remaining hardware required for the full MI BPM system, work out a strategy for constructing and testing full systems prior to the end of the shutdown, and then how to install and commission the systems around the ring once the beam returns after the shutdown. Final front end, online, diagnostic, and control software needs to be written and tested.

**Resources Used in February 2006:**

The total time worked on the project in February 2006 from the Computing Division was 5.7 FTE-months with 16 people contributing. The time worked from the Accelerator Division was 4.2 FTE-months with 14 people contributing. The total time worked from both Divisions was 9.9 FTE-months. The following table gives the estimated or reported effort for both divisions (in FTE-months) since July, 2005.

| Month | AD Effort | CD Effort | Total Effort |
|---|---|---|---|
| July, 2005 | 2.1 | 2.4 | 4.5 |
| August, 2005 | 1.4 | 2.7 | 4.1 |
| September, 2005 | 2.8 | 3.7 | 6.5 |
| October, 2005 | 3.5 | 4.7 | 8.2 |
| November, 2005 | 2.1 | 5.1 | 7.2 |
| December, 2005 | 1.4 | 5.7 | 7.1 |
| January, 2006 | 3.1 | 4.1 | 7.2 |
| February, 2006 | 4.2 | 5.7 | 9.9 |
| SUM (through Feb, 2006) | 20.6 | 34.1 | 54.7 |

The effort listed here is time worked and does not include vacation, sick leave, holidays, etc. February was a big month for the project, consistent with the effort that was needed for the prototype system in MI40 and for the final design and preparation work for the transition board.

**Purchase requisitions/procard obligations through February, 2006:**

The bids for the Transition Module were received in late February. The final award will be made in March, 2006. The final hardware purchases for the project should be made in March and April.

**Milestones:**

| | | |
|---|---|---|
| 1.1.3.2.1.2 | MI BPM: Review (Milestone) | 7/25/2005 |
| 1.1.3.2.4.2 | All Combiner boxes available | 10/25/2005 |
| 1.1.3.2.3.1.3.5 | Transition module PO issued | 1/10/2006 |
| 1.1.3.2.6 | MI BPM system complete | 8/15/2006 |

The PO for the transition module was placed on March 3, 2006.

**Meetings held, Reports Given:**

Meetings were held in February on the following dates:

Project Meetings: February 7, 14, 21, 28 : Minutes beams-doc-1526

**Documents:**

The following documents were written and added to the Accelerator Division Document Database during February, 2006.

2177-v1 Summary of AntiProton Tests for MI BPM UPgrade Robert K Kutschke 27 Feb 2006

2163-v1 MI BPM TBT resolution data Peter Prieto 22 Feb 2006

2158-v1 Discussion of MI BPM Data Validation Work List Robert K Kutschke 21 Feb 2006

2157-v1 A Detailed Look at Closed Orbit Data for the Upgraded MI BPMs Robert K Kutschke 20 Feb 2006

2155-v0 Beam Position Monitor Transition Board Control Module Stefano M RAPISARDA *et. al.* 19 Feb 2006

2154-v0 Electrical Schematic of the Beam Position Monitor Transition Board Control Module Stefano M RAPISARDA *et. al.* 19 Feb 2006

2145-v2 Beam Position Monitor Transition Board Control Module Prototype Stefano M RAPISARDA *et. al.* 19 Feb 2006

2144-v2 Electrical Schematic of the Beam Position Monitor Transition Board Control Module Prototype Stefano M RAPISARDA *et. al.* 19 Feb 2006

2153-v1 Main Injector BPM Test Stand Data Bob Webber 18 Feb 2006

2146-v1 A More Detailed Look at Raw Mode with the Upgraded MI BPM System Robert K Kutschke 10 Feb 2006

1951-v1 Monthly Report of the MI BPM Upgrade Project Steve Wolbers *et. al.* 08 Feb 2006

2129-v1 Raw Mode Measurements in the Upgraded MI BPM System Steve Foulkes 02 Feb 2006

2127-v1 A First Look at Raw Mode data Robert K Kutschke 01 Feb 2006

2080-v2 Comparing H and V MI BPMs Using the Upgraded System Robert K Kutschke 01 Feb 2006

2125-v5 MI BPM Offset Table Log Marv Olson 01 Feb 2006